

## CLAIMS

I claim:

1 1). A method, comprising:  
2 using hardware and software to perform continuous edge profiling on a  
3 program;  
4 detecting profile phase transitions continuously; and  
5 optimizing the program based upon the profile phase transitions and edge  
6 profile.

1 2). The method of claim 1, wherein using hardware and software  
2 comprises:  
3 using software to insert edge profiling instructions and arrange profile  
4 data;  
5 executing the program; and  
6 using hardware to update profile, and signal phase transitions.

1 3). The method of claim 2, wherein using software to insert profiling  
2 instructions comprises modifying branch instructions to assign an identifier  
3 to one or more profiled edges, and to assign a value to an edge selection field.

1 4). The method of claim 3, wherein using software to insert profiling instructions  
2 further comprises inserting a profile identifier instruction when the profiled edge

3 does not have a branch instruction; an initialize profile instruction; and a set  
4 offset instruction.

1 5). The method of claim 2, wherein using hardware comprises translating edge  
2 profiling instructions into profile update operations.

1 6). The method of claim 4, further comprising:  
2 loading a profile information register with a base address, an offset value,  
3 a trigger-counter, and a flag.

1 7). The method of claim 5, further comprising:  
2 intercepting with hardware the profiling instructions;  
3 generating a profile update operation; and  
4 updating profile counters.

1 8). The method of claim 1, wherein detecting profile phase transitions  
2 continuously, comprises generating an interrupt signal by the hardware when the  
3 profile phase transition occurs.

1 9). The method of claim 8, further comprising:  
2 determining if a program edge is hot, comprising  
3 determining if the profiling instruction is executed, and

4 updating profiling counters associated with the profiling instruction;  
5 determining if a cold edge becomes a hot edge, comprising  
6 incrementing and decrementing trigger counters, and  
7 detecting if trigger counters overflow and underflow;  
8 preventing a false phase transition by detecting trigger counters underflow.

1 10). A system, comprising:  
2 a processor pipeline configured to generate a profile ID for each profiled edge,  
3 and generate profile update operations;  
4 a profile information register coupled to the processor pipeline;  
5 a first logic device configured to accept the profile update operations and profile  
6 ID to generate a memory buffer address;  
7 a profile cache for accepting the buffer address connected to the first logic  
8 device; and  
9 a second logic device connected to the profile cache configured to generate a  
10 phase transition interrupt signal,  
11 wherein the system performs edge profiling on a program, detects profile phase  
12 transitions continuously, and optimizes the program based upon the profile  
13 phase transitions.

1 11). The system of claim 10, wherein the processor pipeline  
2 executes the program;

3        intercepts profiling instructions and updates profile counters; and  
4        updates profile phase transition trigger counters, and  
5        signals phase transitions.

1    12).    The system of claim 11, wherein the software inserts edge profiling  
2    instructions for modifying branch instructions to assign an identifier to one or  
3    more profiled edges, and to assign a value to an edge selection field.

1    13).    The system of claim 12, wherein the software while inserting edge profiling  
2    instructions, also inserts a profile identifier instruction when the profiled edge  
3    does not have a branch instruction; an initialize profile instruction; and a set  
4    offset instruction.

1    14).    The system of claim 11, wherein the processor translates edge profiling  
2    instructions into profile update operations.

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2    15).    The system of claim 13, wherein the processor pipeline loads a profile  
3    information register with a base address, an offset value, a trigger-counter,  
4    and a flag.

1    16).    The system of claim 14, wherein the processor pipeline:  
2    intercepts the profiling instructions;

3 generates a profile update operation; and  
4 updates profile counters.

1 17). The system of claim 10, wherein the logic device generates an interrupt  
2 signal when the profile phase transition occurs.

1 18). The system of claim 17, wherein the processor:  
2 determines if a program edge is hot, by determining if the profiling instruction is  
3 executed, updating profile counters associated with the profiling instruction,  
4 and determining if the trigger counters overflow;  
5 determines if a cold edge becomes a hot edge, comprising  
6 incrementing and decrementing trigger counters, and  
7 detecting if trigger counters overflow and underflow;  
8 preventing a false phase transition by detecting trigger counters underflow.

1 19). A computer-readable medium having stored thereon a plurality of  
2 instructions, said plurality of instructions when executed by a computer, cause  
3 said computer to perform:  
4 using hardware and software to perform continuous edge profiling on a  
5 program;  
6 detecting profile phase transitions continuously; and

7 optimizing the program based upon the profile phase transitions and edge  
8 profile.

1 20). The computer-readable medium of claim 19 having stored thereon  
2 additional instructions, said additional instructions when executed by a  
3 computer for using hardware and software to perform edge profiling on a  
4 program, cause said computer to further perform:

5 using software to insert edge profiling instructions and arrange  
6 profile data;  
7 executing the program; and  
8 using hardware to update profile phase transitions, and signal  
9 phase transitions.

1 21). The computer-readable medium of claim 20 having stored thereon  
2 additional instructions, said additional instructions when executed by a  
3 computer for using software to insert edge profiling instructions, cause said  
4 computer to further perform:

5 modifying branch instructions to assign an identifier to one or more  
6 profiled edges, and to assign a value to an edge selection field.

1 22). The computer-readable medium of claim 21 having stored thereon  
2 additional instructions, said additional instructions when executed by a

3 computer for using software to insert edge profiling instructions, cause said  
4 computer to further perform:

5 inserting a profile identifier instruction; when the profiled edge does  
6 not have a branch instruction, an initialize profile instruction, and  
7 a set offset instruction.

1 23). The computer-readable medium of claim 20, having stored thereon  
2 additional instructions, said additional instructions when executed by a  
3 computer for using hardware, cause said computer to further perform  
4 translating edge profiling instructions into profile update operations.

1 24). The computer-readable medium of claim 22 having stored thereon  
2 additional instructions, said additional instructions when executed by a  
3 computer, cause said computer to further perform:  
4 loading a profile information register with a base address, an offset  
5 value, a trigger-counter, and a flag.

1 25). The computer-readable medium of claim 23 having stored thereon  
2 additional instructions, said additional instructions when executed by a  
3 computer, cause said computer to further perform:  
4 intercepting with the hardware the profiling instructions;  
5 generating a profile update operation; and

6 updating profile counters.

1 26). The computer-readable medium of claim 19 having stored thereon  
2 additional instructions, said additional instructions when executed by a  
3 computer for detecting profile phase transitions continuously, cause said  
4 computer to further perform:

5 generating an interrupt signal by the hardware when the profile phase  
6 transition occurs.

1 27). The computer-readable medium of claim 26 having stored thereon  
2 additional instructions, said additional instructions when executed by a  
3 computer for detecting profile phase transitions continuously, cause said  
4 computer to further perform:

5 determining if a program edge is hot, comprising  
6 determining if the profiling instruction is executed, and  
7 updating profile counters associated with the profiling instruction;  
8 determining if a cold edge becomes a hot edge, comprising  
9 incrementing or decrementing trigger counters, and  
10 detecting if trigger counters overflow and underflow;  
11 preventing a false phase transition by detecting trigger counters  
12 underflow.